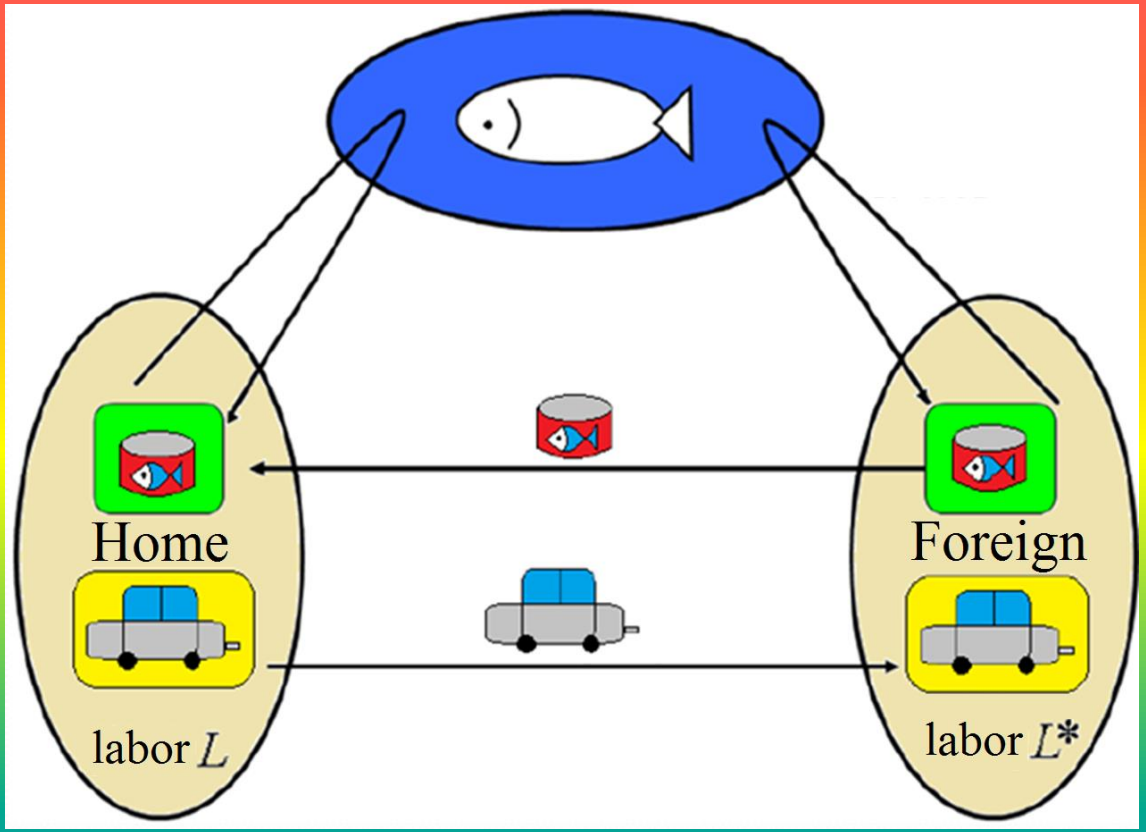
Fishing Quotas can be Justified under Common Price of Shared Resources?



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Introduction

- **Theme: Is distribution of *fishing quotas* better policy under *common* resources?**

- Characterization of ***common fishing resources*** like various tunas and eels, and so on.

1. International problem because of importance (lonely management has limited effects)
2. Large volume of trade in fisheries industry
3. ***Fishing (Resource-Good) Price*** : important.

$\Rightarrow$ ***(individual) fishing quota*** is focused on.

Requirement of Justifying fishing quota

- **Policy of *fishing quota***: needs some fishing effort/ labor

⇒Incomplete specialization (both fishery's resource and non-fisheries goods are produced.)

<Requirement of Justifying fishing quota>

- Each country wants fishing quota ***intrinsically***.

⇒Preventing overfishing, fishing quota is used.

⇒**Doubting** "***intrinsically***" in this research.

Previous Researches(1/3)

- Past days: **trade theory and fisheries economics are separated**: like Clark (1975), Clark and Munro (1979) called "Clark model" (improved Gordon= Schaefer model) based on partial analysis of one-good model is the most popular basic model
- Especially in internationally shared renewable stocks,

➢ Munro(1979), Vislie(1987): if negotiation is used for percentage of effect, management is done **by only one country** even if two countries are affected it.

➢ Levhari and Mirman(1980): **by non-cooperation**, steady-state shared stocks are decreased against perfectly cooperation.

Previous Researches(2/3)

- Brander and Taylor(1997a, 1998): **combining Clark's model to Ricardian Trading model**: Showing the importance of renewable resources management within domestic types of resources.
- Rus(2012), Takarada et al.(2013): changes Brander= Taylor model to internationally shared resources.
- Rus(2012): Analysis for local resources connecting paths to exchange living area of resources each other: **too complex not to use "common" resources** like tuna, eels, and so on.

cf. Sanchirico and Wilen (1999), Costello and Polasky (2008): Patchy Environment

cf. Bulte and Damania(2005): Partial equil. analysis of shared stock of fisheries and non-fisheries industries.

Previous Researches (3/3)

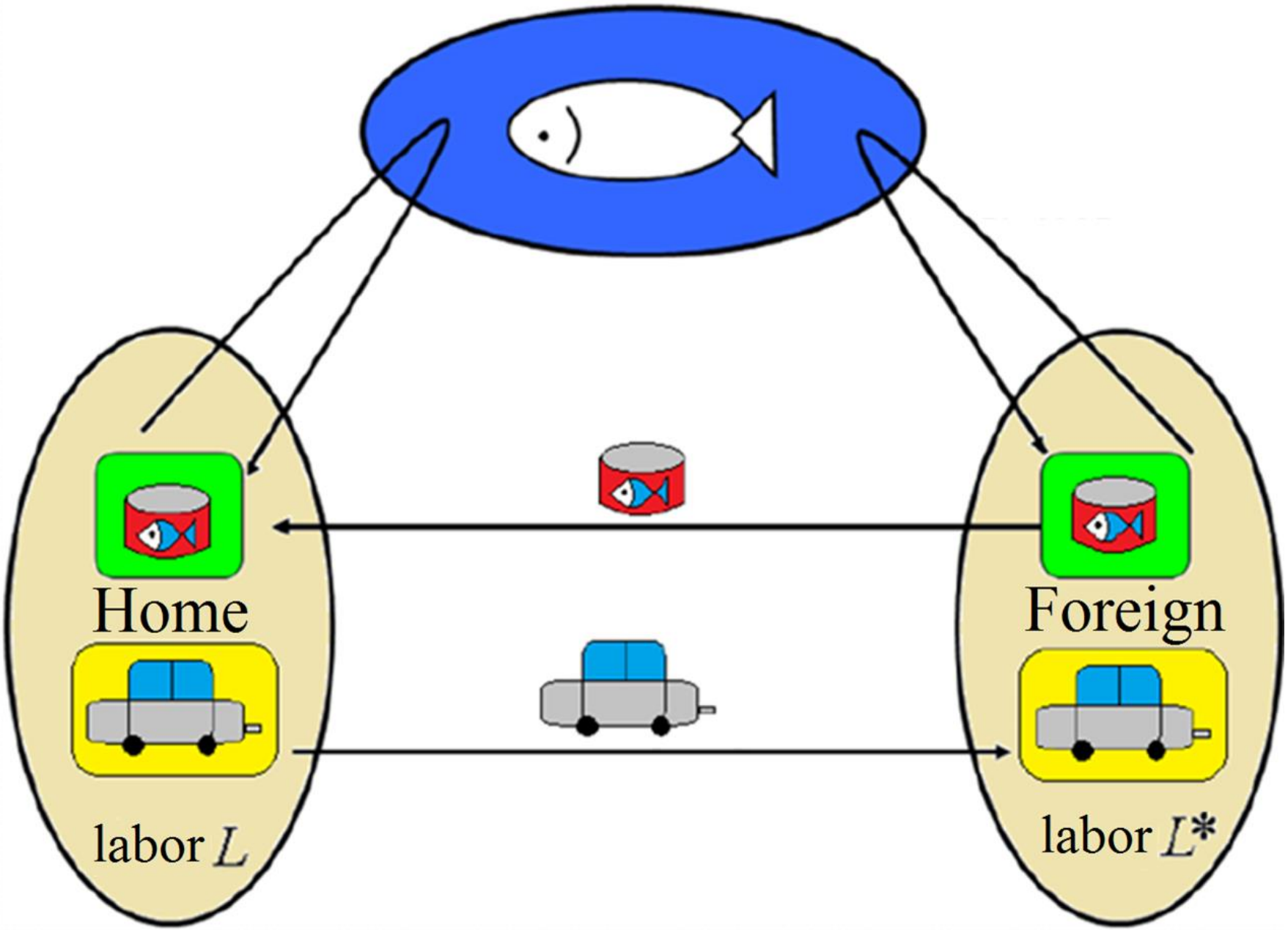
- **Takarada et al.(2013, RIE): Trade opening with common renewable resource-good using GE: steady state resource (↓), analysis for each country's economic welfare: little management.** cf. Golubtsov and McKelevy (2007)
- Takarada (2010, DP): Analysis of cooperative management of common resource with technical regulation: not fundamental for efficient management
- Takarada et al. (2012, WP): Analysis with revenue taxes management of common resource: suitable for Ricardo model: **every country's incomplete specialization cannot occur (one country manages)**.

⇒**How about differential game including common stock's dynamic equation where both countries decide (incomplete specialization's) resource-good quota non-cooperatively?**

What is done on this research?

- **Introducing each country's non-cooperative fishing quota with Takarada et al. (2013)** as internationally shared common resource trading (general equil.) model.
- **Analysis of differential game** treating common resource stock's movement's dynamic equations
- Result : **any country's incomplete specialization equil. made by each country requires fishing quotas non-cooperatively with an interior points does NOT exist.**
- Resource management is done by only one country.
- About solution concept, not only open-loop where firstly any plan is made but also Feedback-Nash equil. (better for economics) where each country can change seeing stocks can be used for deriving main results.

Figure of Key Concepts



Model Settings with general equil. (GE)

- ***GE. Trade model with common resource S***
- 2-good (fishery's good *H*, manufactures *M*), labor *L*
- 2-country: home (H-importing), foreign* (H-exporting) (as aggregation of the world)
- Instant welfare: log-linear, discount rate: $\rho(>0)$
- Based on Takarada et al. (2013), where Clark's model (in Fisheries Economics) are applied on trading model with common resources, ***gain function of resource, production and catch function can be generalized*** (with both decreasing and constant return to scale case).

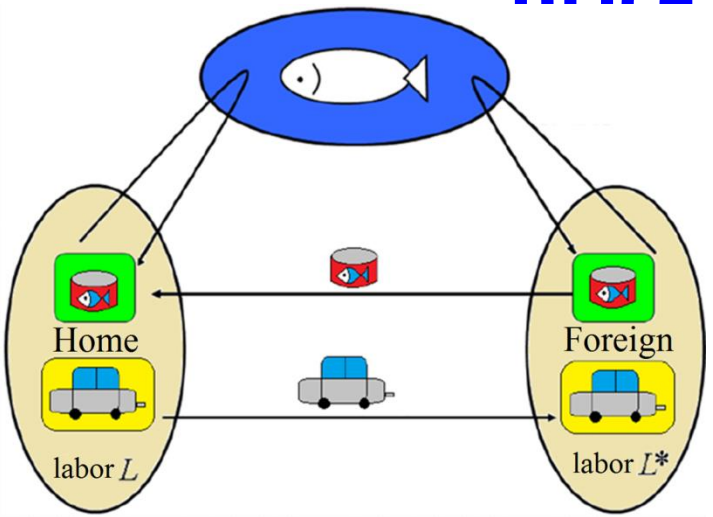
Methods of Model Setting

- Each country uncooperatively maximizes each country's economic welfare ***considering fish price (as variable) and international equil. condition (as constraint)***.
- ***Differential Games*** treating strategy and resource's transition (Solution concept can be forginen as not only open-loop equil. but also feedback Nash equil.)
- (Key explanation can be generalized as repeated games.)

Key Conditions of Proposition 1

<Key Conditions>

- **Internationally Common Shared Resource**
- Resource-good market is internationally common
- **fish price *p*** is internationally **common** essentially
- Each country **considers fish price *p* (*p* is variable)**
- **International equil. condition is a "constraint" (with inequality with an equal sign) for each country**



Proposition 1 (Main Result)

- **Proposition: Consider both home and foreign countries maximize each economic welfare uncooperatively with not only catch amounts (common resource good) *H* *but also fish price p under the international equil. condition*.**
- **There is *NO* equil. where both countries choose incomplete specialization and produces both fishing good *H* and manufactures *M* *in ANY transition process*, thus *at least one country must specialize one industry*.**
- **This result holds in not only open-loop equil. but also Feedback-Nash equil.**
- **(This result can be applied Quota's theory.)**

Figure of Key Results

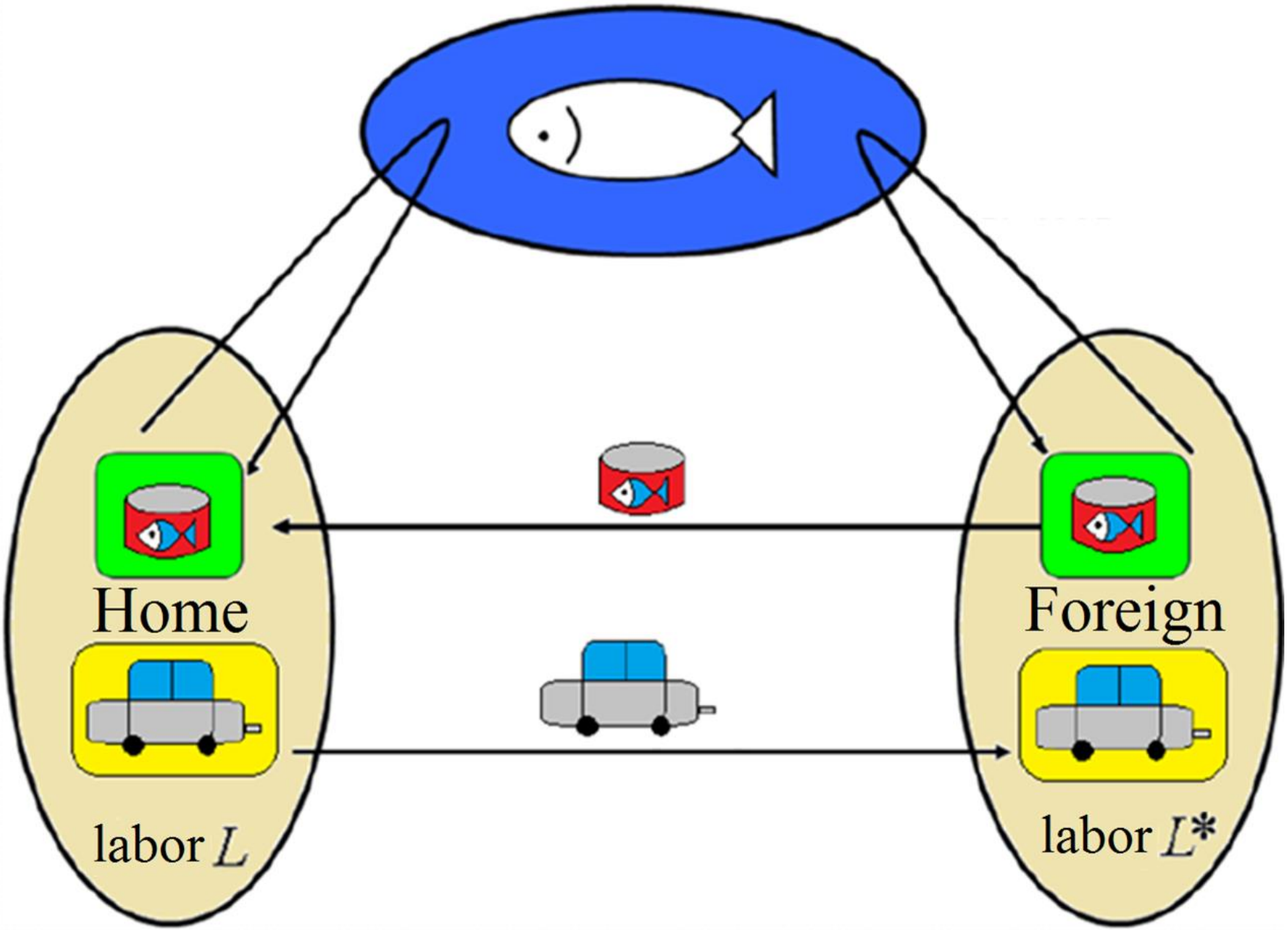
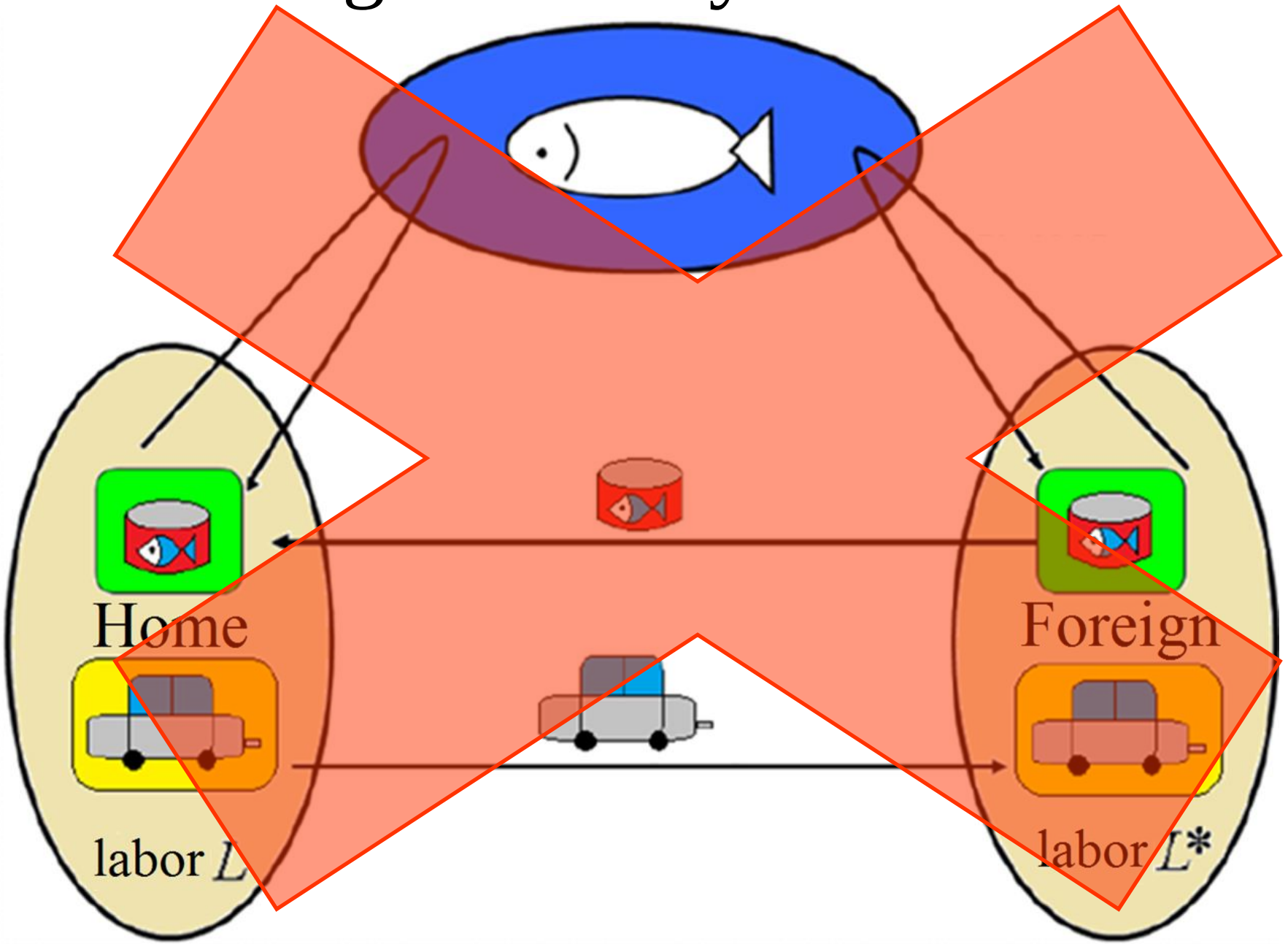


Figure of Key Results



Sketch of proof of Prop. 1

- Key Points: At interior solution deriving incomplete solutions, first-order necessary conditions (FONC) of interior solutions must be held **with fishing price variable in both home and foreign countries**.
- By the way, production of non-fishery good *M* is necessary in the world. However, if non-fishery good are produced, about Lagrange function composed static international equil. condition with Hamilton function, when trade actually happens, **FONC of interior solutions of fish price variable in both home and foreign countries cannot be compatible under international trade equil.**

Meaning of Prop.1

- ***The premise of justification of fishing quota is broken.***
- Analysis without both countries' incomplete specialization has meaning. (Takarada et al. (2012))
- **Ideal situation: *Determination of priority of fishing countries and world's total catch amount*: Concentration of fishing countries satisfying total catch amount is better than introducing IQ and IFQ.**
- If both countries' incomplete specializations hold in international trading equil., **at least one country does NOT maximize the country's welfare.**

Extension to this result

- If fishing countries cannot be determined because of lacking some information and so on, **collecting fishing quota to efficient persons** using individual tradable quota (**ITQ**) **has meaning** to collect quotas for the role of efficient country (or individual) which should works on fishery. (***non-tradable quota (like IQ or IFQ) is NG***)
- cf. Home: incomplete specialization,

  Foreign: specialization of fishing } $\Rightarrow$ common resource amount tends to decrease ($\downarrow$) with starting to trade. If home country considers foreign country's specialization, the decreasing of resource amount becomes higher.

Robustness of This Result

- Corollary: If fish price *p*'s movement is a **dynamic equation**, and if each country's discount rate is the same, Proposition 1 holds in the **steady state**.
- Whether the resource-good harvesting function and non-resource-good production function are CRS or DRS, **do NOT affect** in the results.
- The result holds both natural harvesting and **farm-fattened** (like Japanese and Chinese seels).
- The result does **not depend on the gain function** of the common resource, that is, intrinsic rate, carrying capacity, MSY, ABC, and so on.
- Key results hold when we use ***repeated games***.

Composing the Previous Researches

- Like Munro(1979) and Vislie(1987) using partial equilibrium, **the result that only one country considers resource management** holds in GE.
- Takarada et al.(2012), which treats management of revenue tax on GE, is **without loss of generality**.

➢ Merit) Opening trade's effect and management's effect can be separated for analysis.

➢ Demerit) Based on Ricardo model, it cannot analyze both countries' incomplete specialization: **This research implies that the demerit disappears.**

- ***Disappears justification of Cournot competition of countries' fishing quota in common resources.***

Takarada's et al.(2012) http://bit.ly/1osZE4A

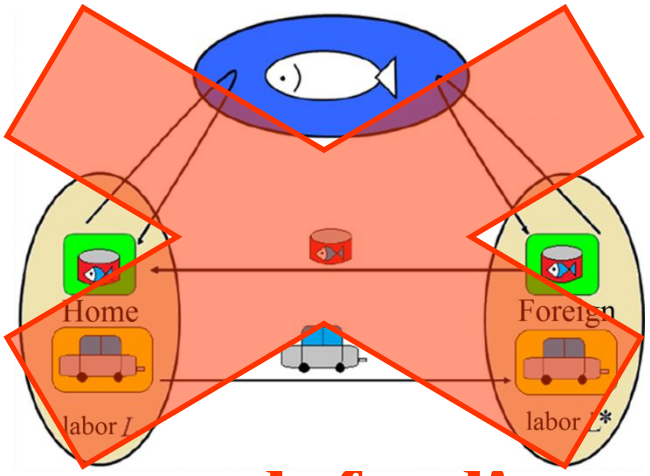
- Management with revenue tax has the same effect of input controls theoretically, and of output controls on the stable equil. with positive amount.
- When both countries harvest resources in common resource, the management side **is the resource-good importing country**, which wants to rent and tends to loosen management for fisheries stock.
- Different to domestic resource, **the resource-good exporting country** which has rent from fisheries, **should help the resource-good importing country** for world first-best (efficient) resource management.
- Our result implies **the importance** of the research.

Conclusion

- This research analyzes each country's welfare maximization to choose each country's fishing quota with non-cooperative differential game, based on Takarada et al. (2013) which is the internationally common resource model with genaral equilibrium.
- **There is no equil. where each country chooses incomplete specialization (,that is, interior solution of fishing quota)**.
- This result shows that **distributing each country's non-tradable fishing quota is NOT justified as economic second-best** in the common resource, common resource price considered as variable.

Future Extensions and Future Tasks

- This research does not derive explicit solution.
- Comparative statics, analysis of transition pass, stability become future tasks.
- Gains from trade and internalization of trade patterns become future tasks. Especially, the purpose of the maximization problem becomes future tasks.



- **Thank you very much for listening to my story.**

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